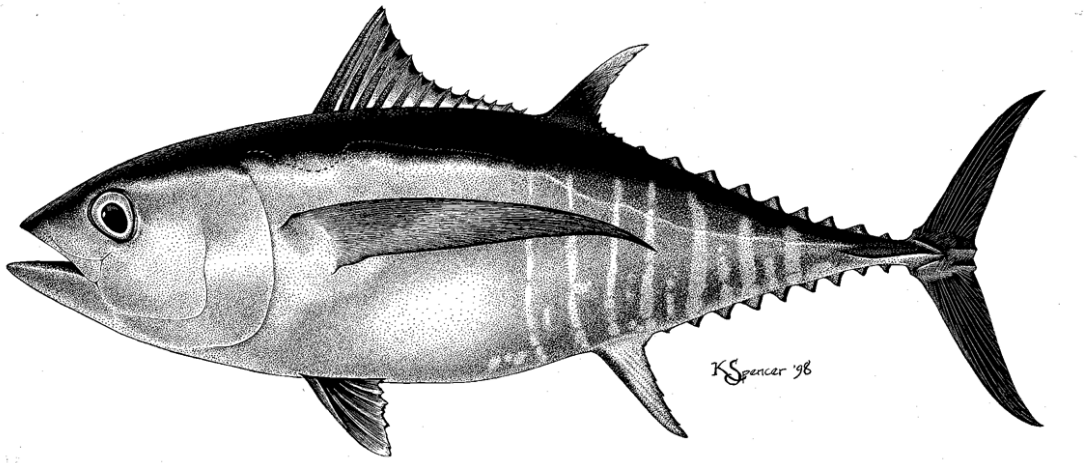
STATUS OF BIGEYE TUNA IN THE EASTERN PACIFIC OCEAN IN 2014

January 1975 – December 2014



6th Meeting of the IATTC Scientific Advisory Meeting

La Jolla, California (USA), 11-15 May 2015

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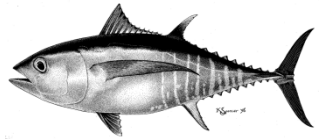
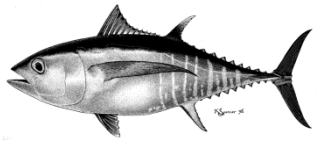
Outline



- Update stock assessment (base case model)
  - Fishery data updates
  - Model assumptions
  - Results (fishing mortality, recruitment, biomasses)
  - Stock status (base case)
  - Population projections (*status quo* and F_{MSY})
- Stock-recruitment sensitivity analysis

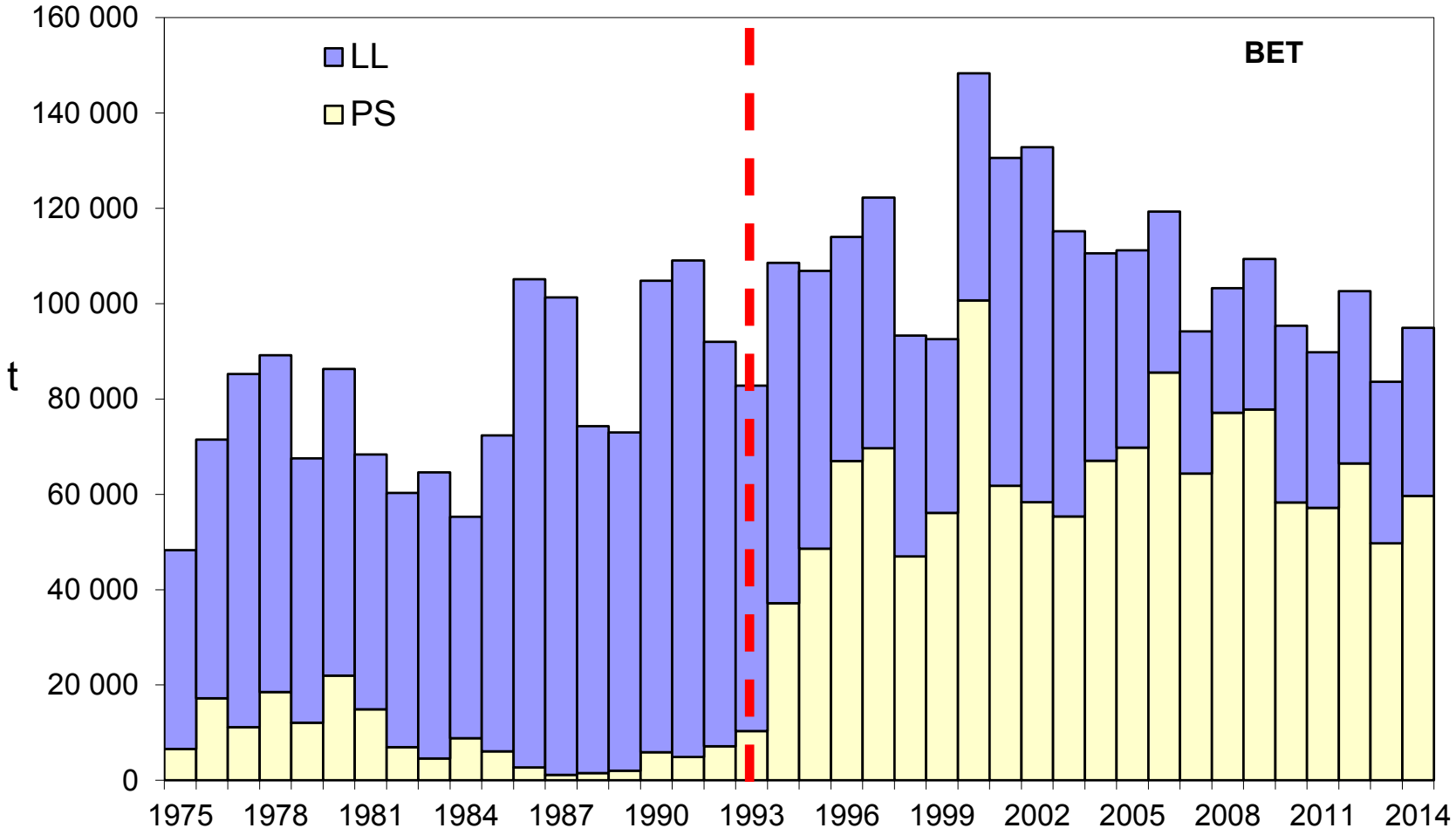
  (steepness = 0.75)
- Summary conclusions from stock assessment
- Indicators from purse seine sets of floating-objects



New or updated data

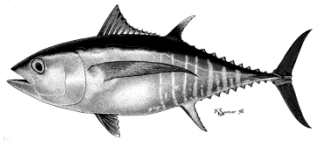
- Surface fisheries
  - Catch, CPUE and size-frequency data updated to include new data for 2014 and revised data for earlier years
- Longline fisheries
  - New or updated longline catch data: China (2013), Chinese Taipei (2011-2012), Japan (2008-2013), Korea (2013), US (2012-2013), French Polynesia (2013) and Vanuatu (2013-2014)
  - 2014 longline catch data available from monthly reports: China, Chinese Taipei, Japan and Korea
  - New or updated CPUE data available for Japan (2008-2013)
  - New or updated longline size-frequency for Japan (2011-2013)

Total catches



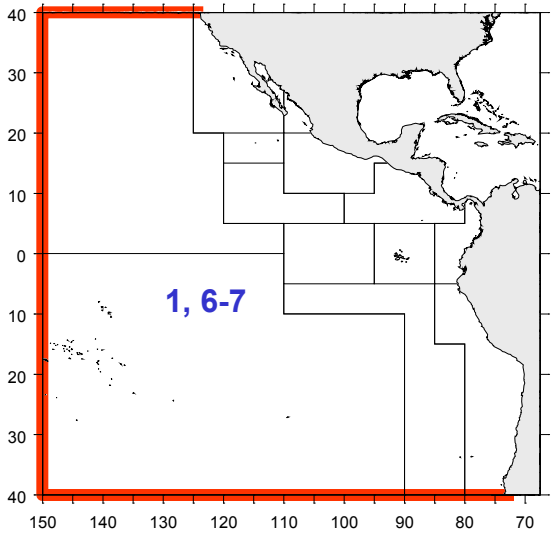
Expansion of FAD fishery

BET fishery definitions

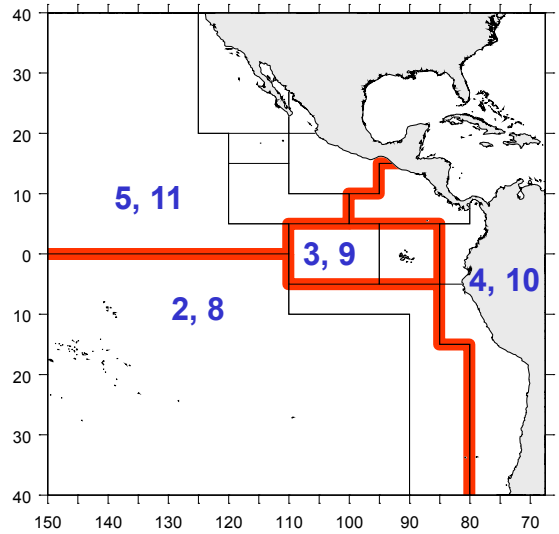


23 fisheries

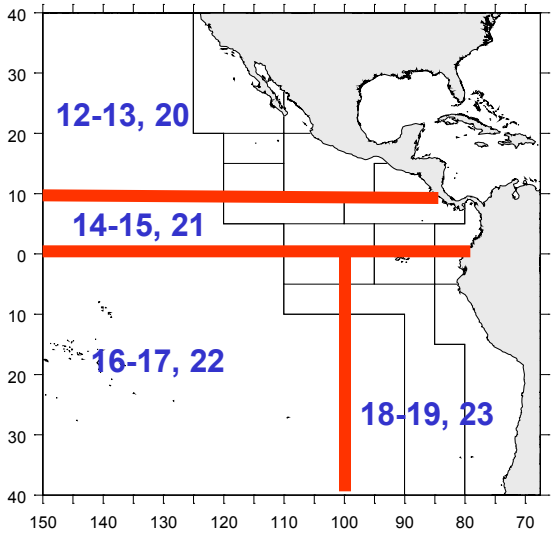
Early OBJ (1)
Early & Late DEL&NOA (6, 7)



Recent OBJ (2-5)
Discards (8-11)



Early/Late LL N (12-13, 20)
Early/Late LL C (14-15, 21)
Early/Late LL S (16-17, 22)
Early/Late LL I (18-19, 23)



GEAR TYPE: PS, LP, LL

PS set type (OBJ, NOA and DOL)

Time period

The IATTC sampling areas

DEL – sets on dolphins

NOA – sets on unassociated fish

OBJ – sets on floating objects

LL – longline sets

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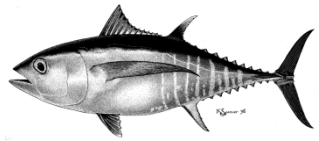

Model assumptions

- Improved after External Review in May 2010 and recent diagnostics work (R_0 profile)
- Data weighting:
  - Down-weighting size composition data of all fisheries
  - Fit to Central and Southern LL CPUE series (CV=0.15), no fit to purse seine CPUE
- Modeling of catchability and selectivity:
  - Two time blocks for all LL fisheries (split at 1990)
  - Early dome-shape, late asymptotic selectivities (LL-C, LL-S)
  - Dome-shape selectivity for all surface fisheries

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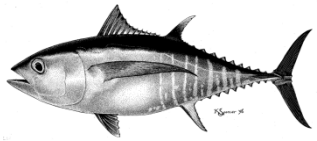
Model assumptions (cont.)



- Growth modeling: New growth curve estimated externally, L_2 and variance of length-at-age fixed

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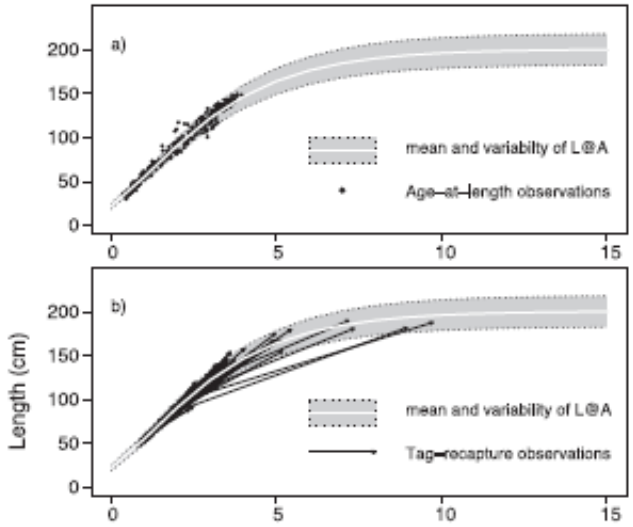
Improved growth estimates from integrated analysis of direct aging and tag–recapture data: An illustration with bigeye tuna (*Thunnus obesus*) of the eastern Pacific Ocean with implications for management

Alexandre M. Aires-da-Silva*, Mark N. Maunder, Kurt M. Schaefer, Daniel W. Fuller

Inter-American Tropical Tuna Commission, 8901 La Jolla Shores Drive, La Jolla, CA 92037-1508, United States



Model fit to indices of abundance

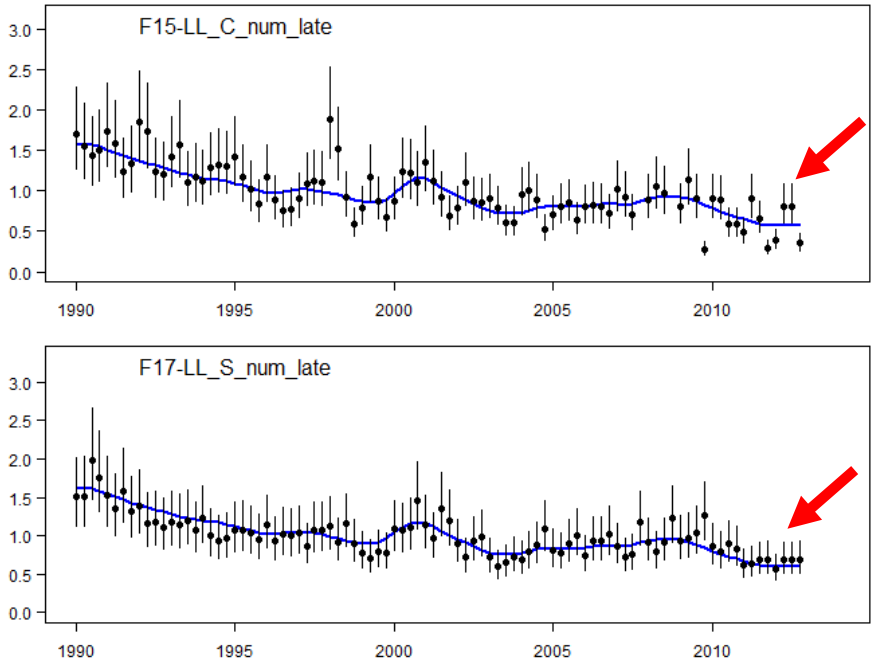
Results (base case)

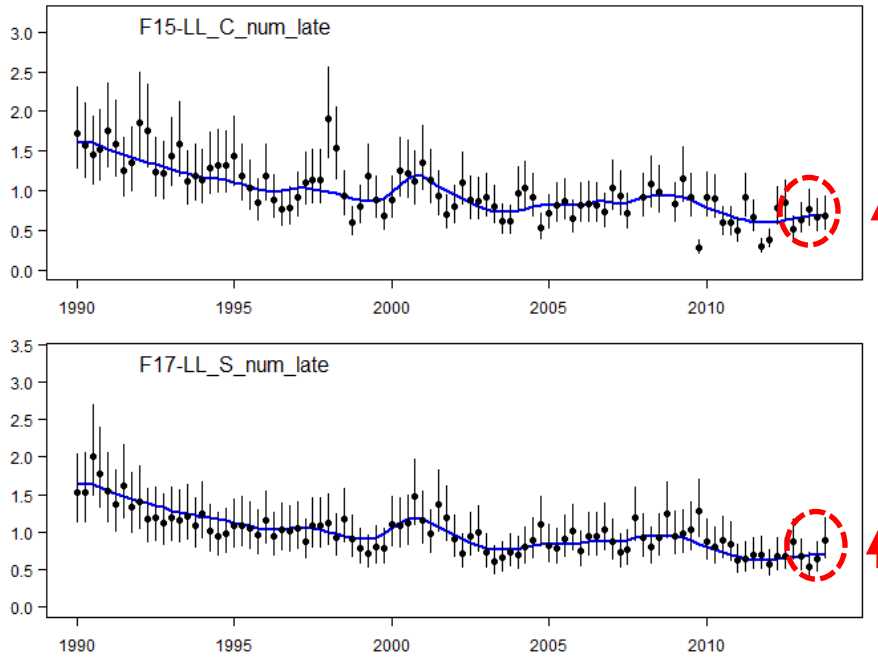
SAC 5 (2014)

SAC 6 (2015)

Catch per day (t) - Captura por dia (t)

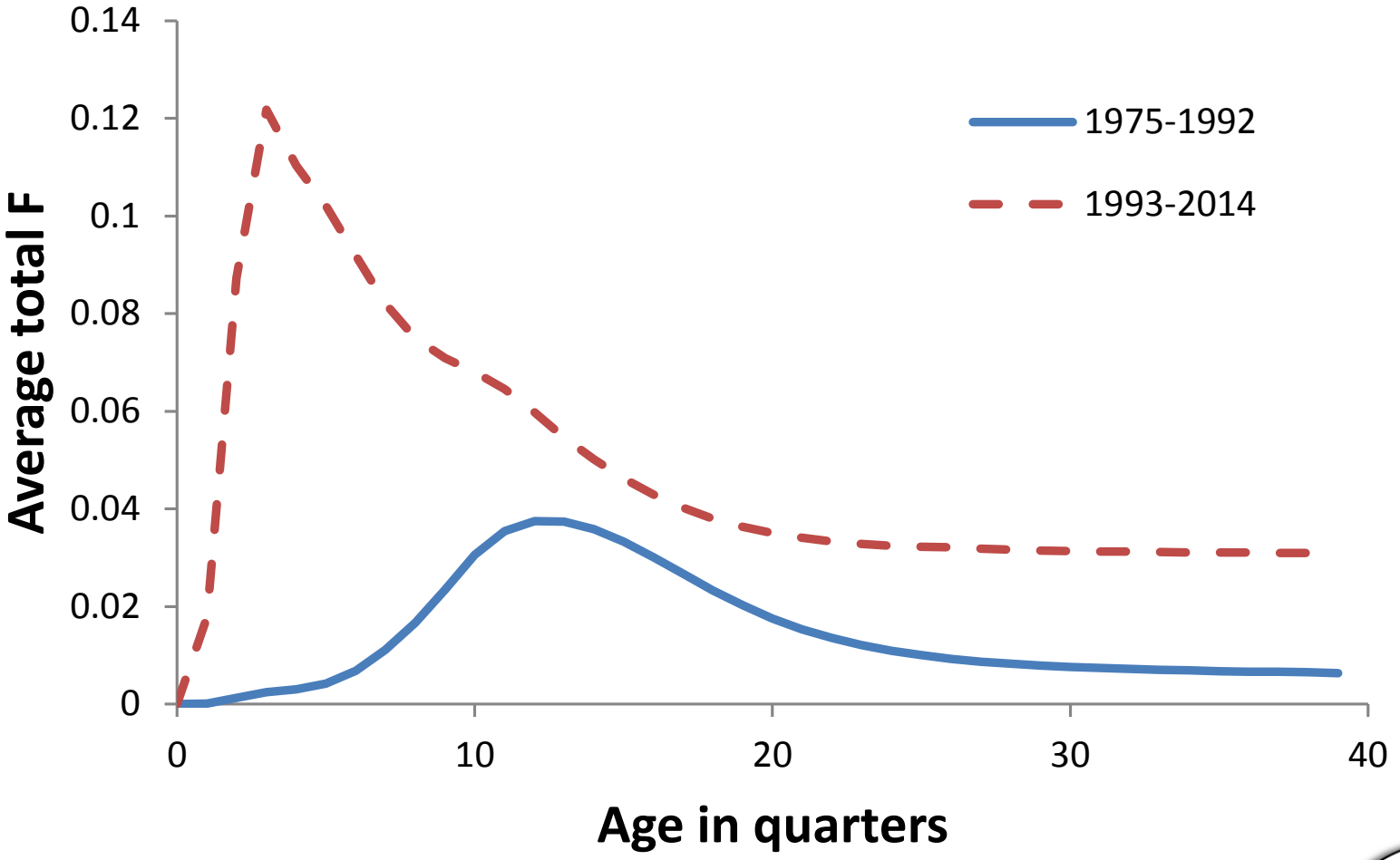
Standardized CPUE - CPUE estandarizada





Age-specific fishing mortality

Results
(base case)



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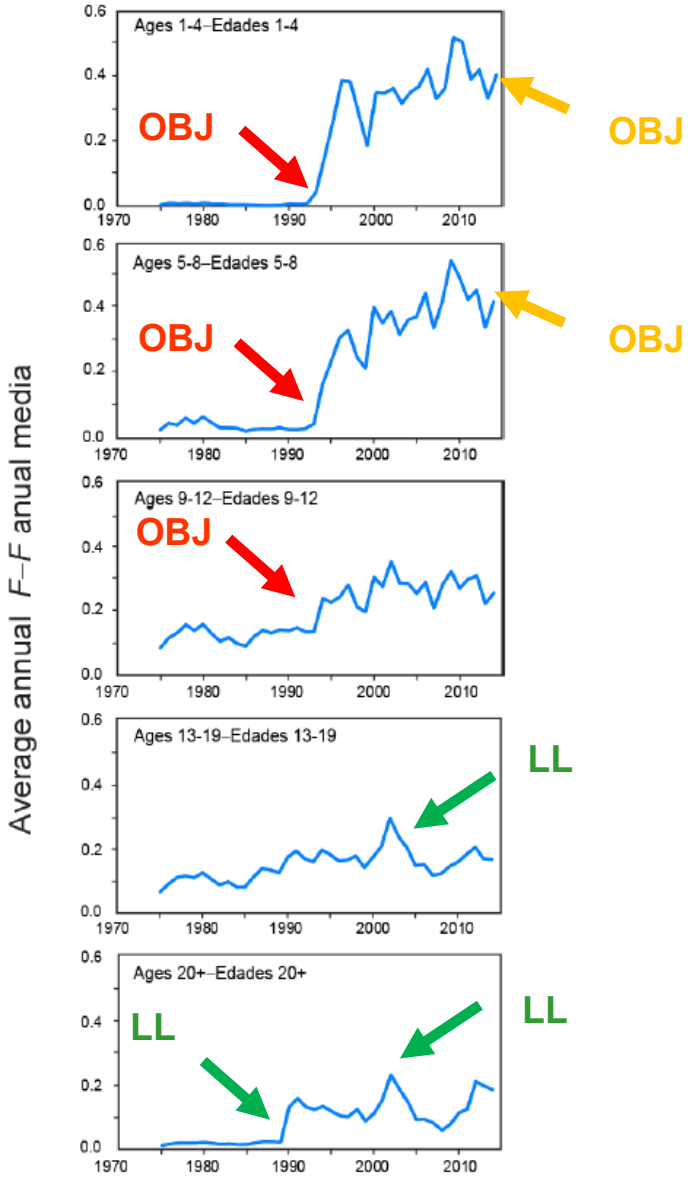
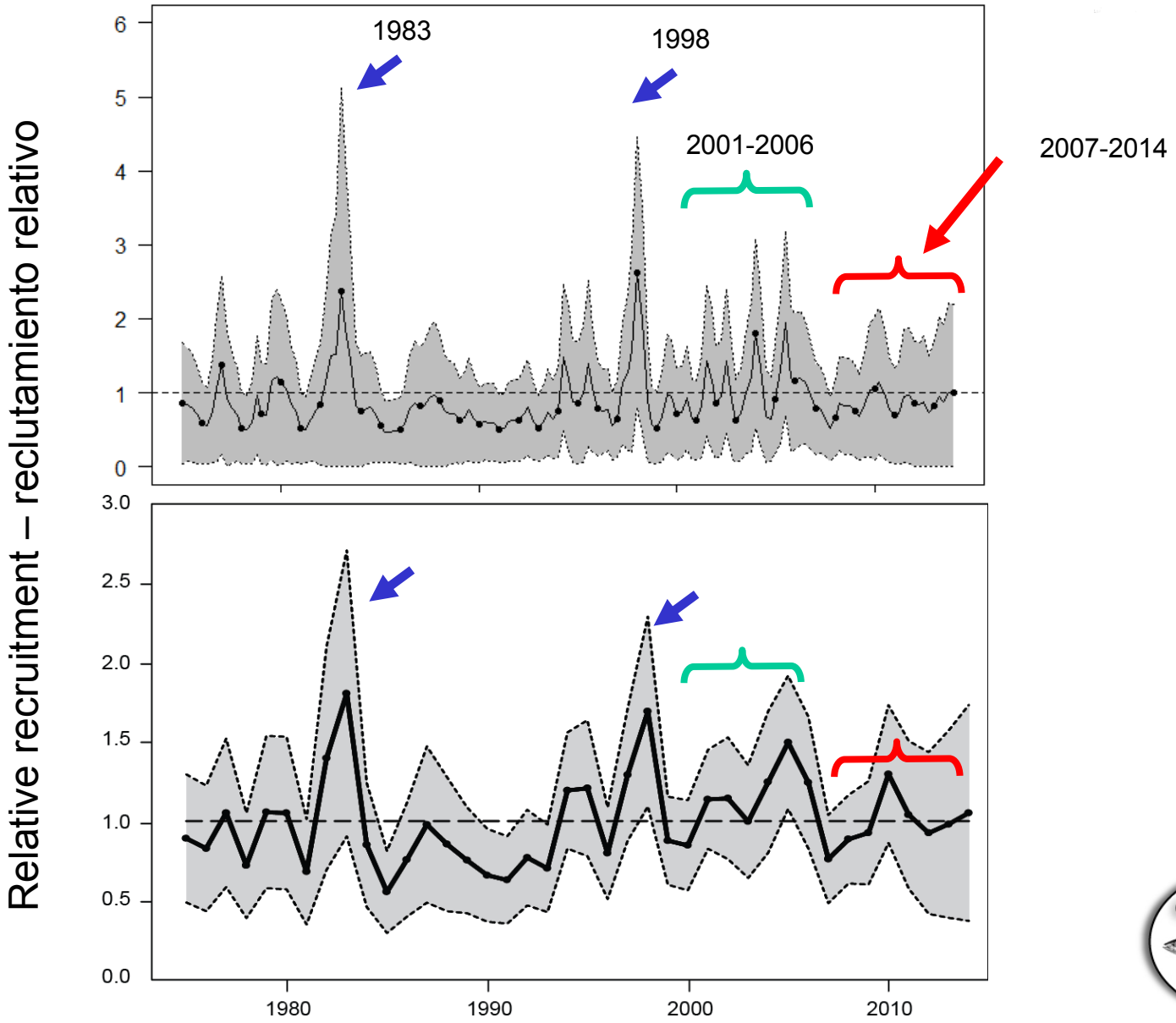
Fishing mortality (F)

Results
(base case)



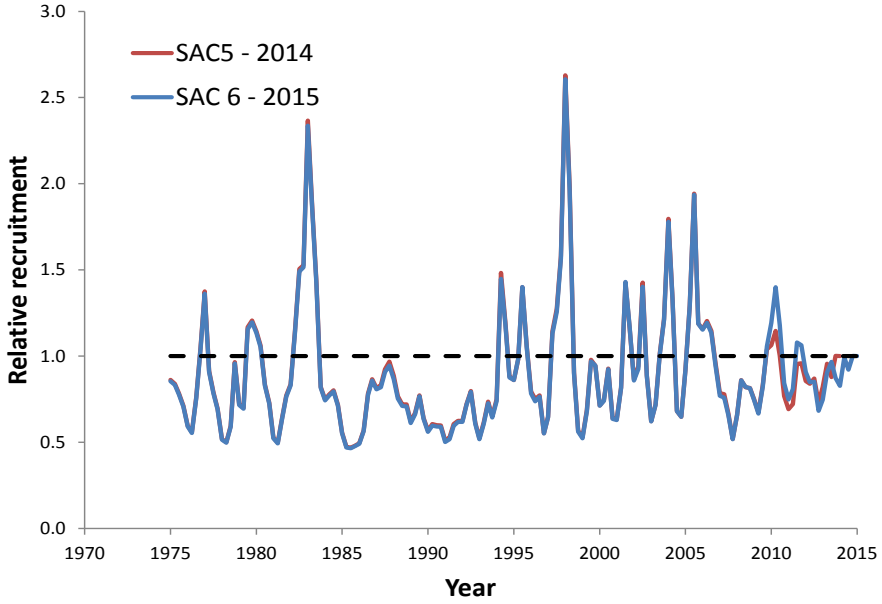
Recruitment

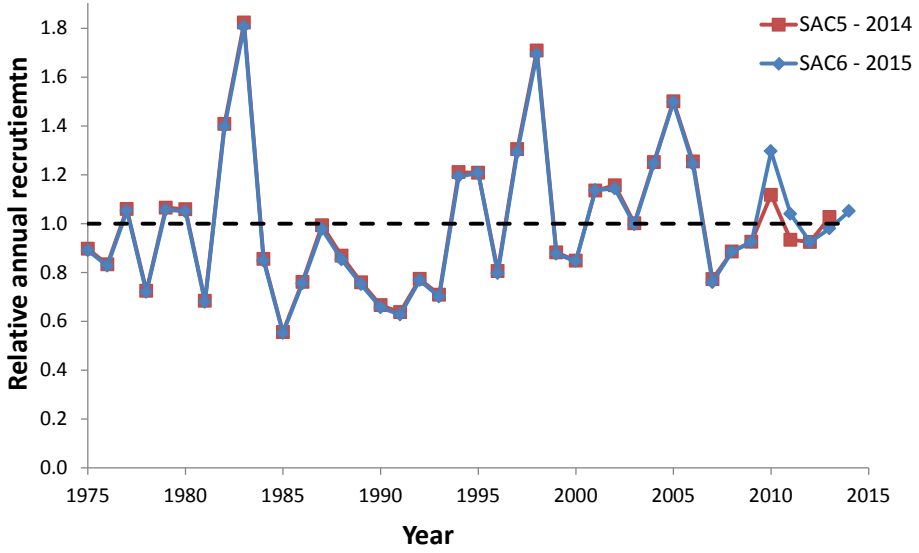
Results
(base case)



Recruitment – comparisons with previous assessment

Results (base case)





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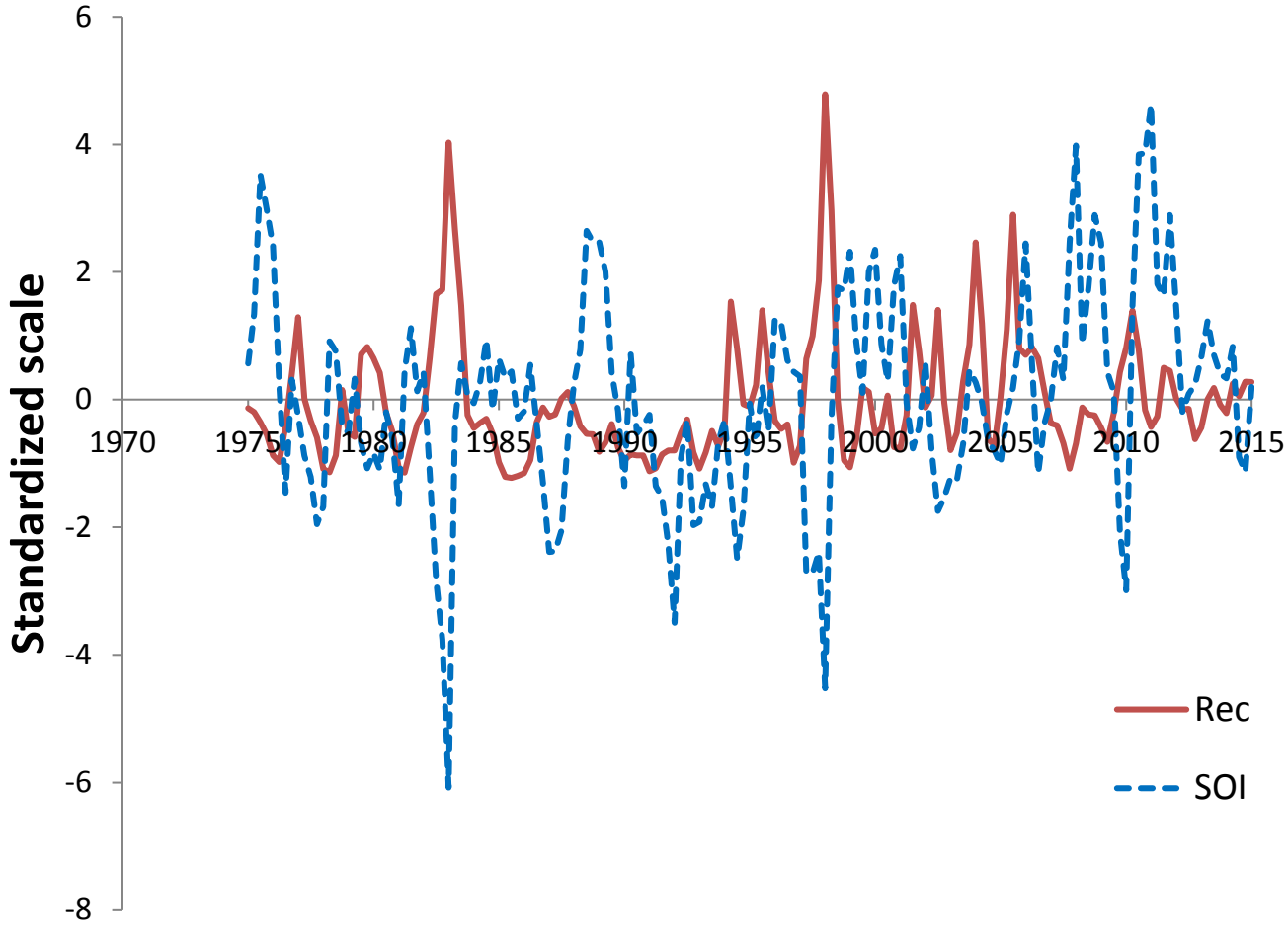
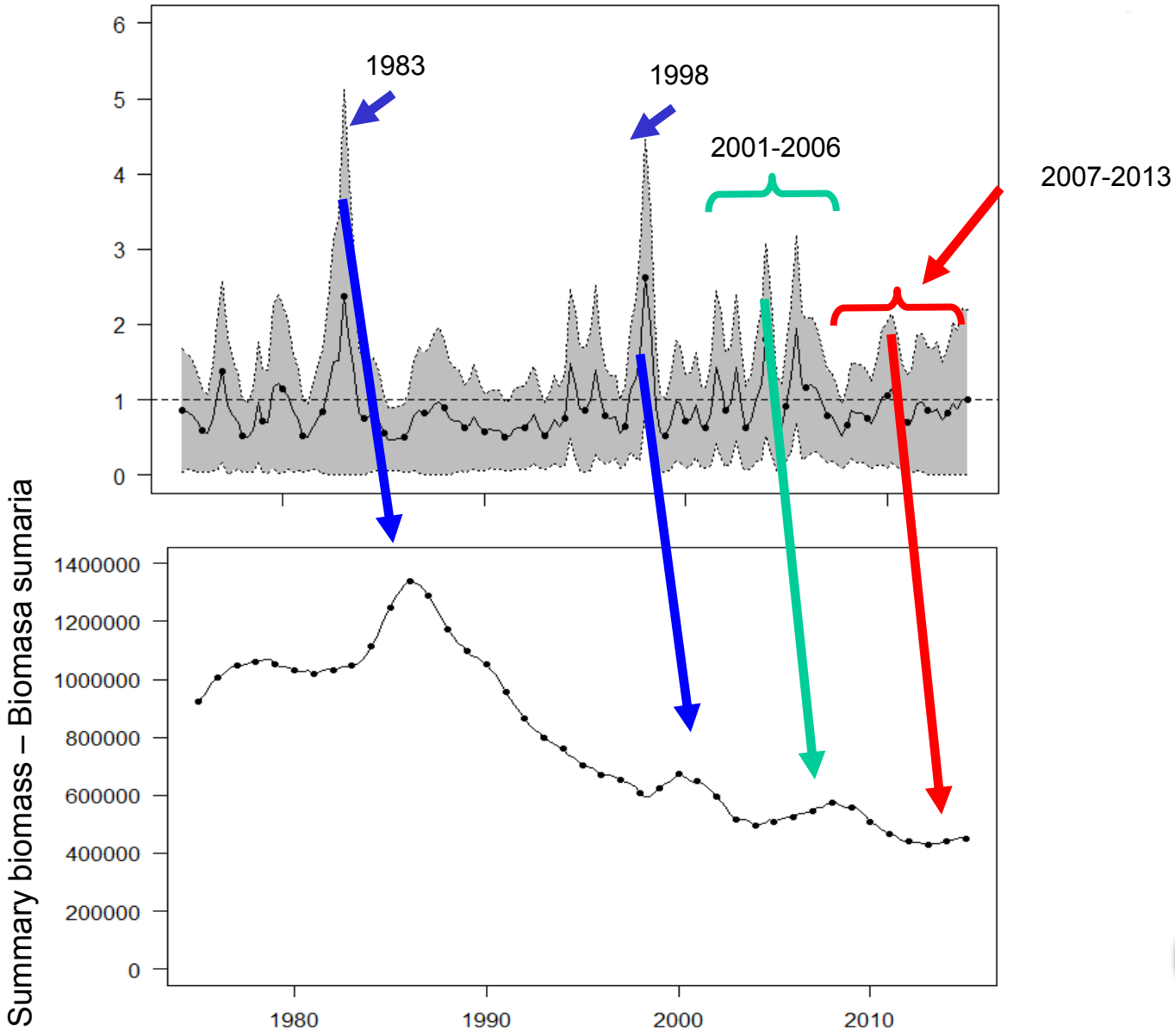
Recruitment and environment

Results
(base case)

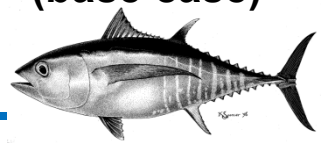


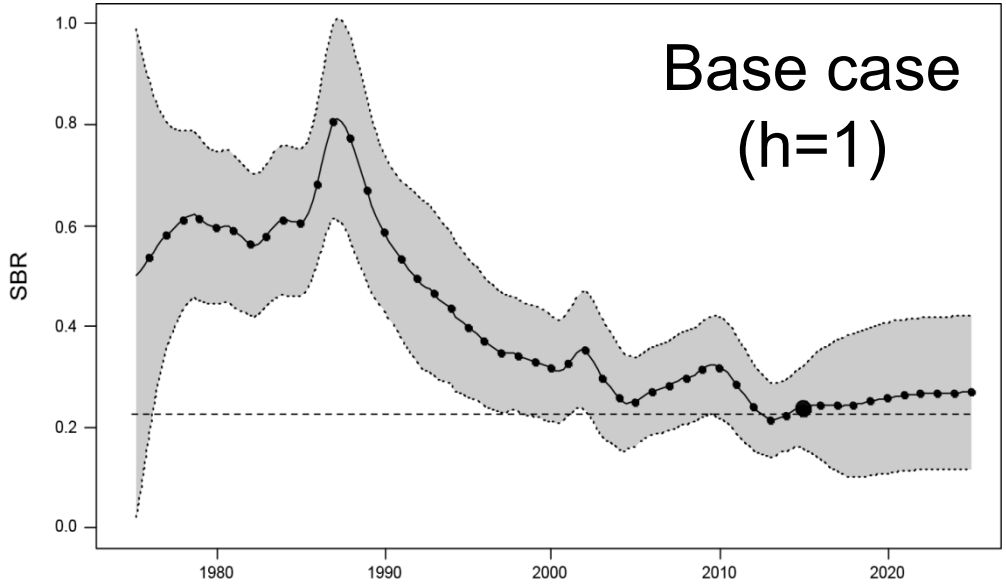
Summary biomass

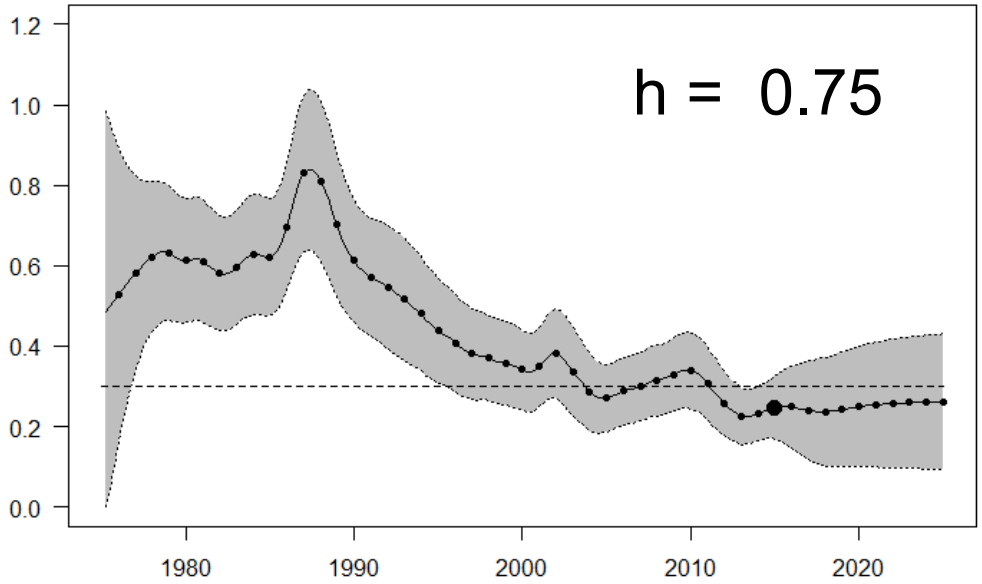
Results
(base case)



Spawning Biomass Ratio (SBR)

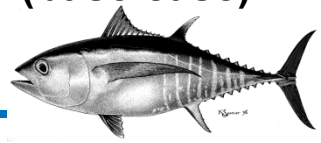


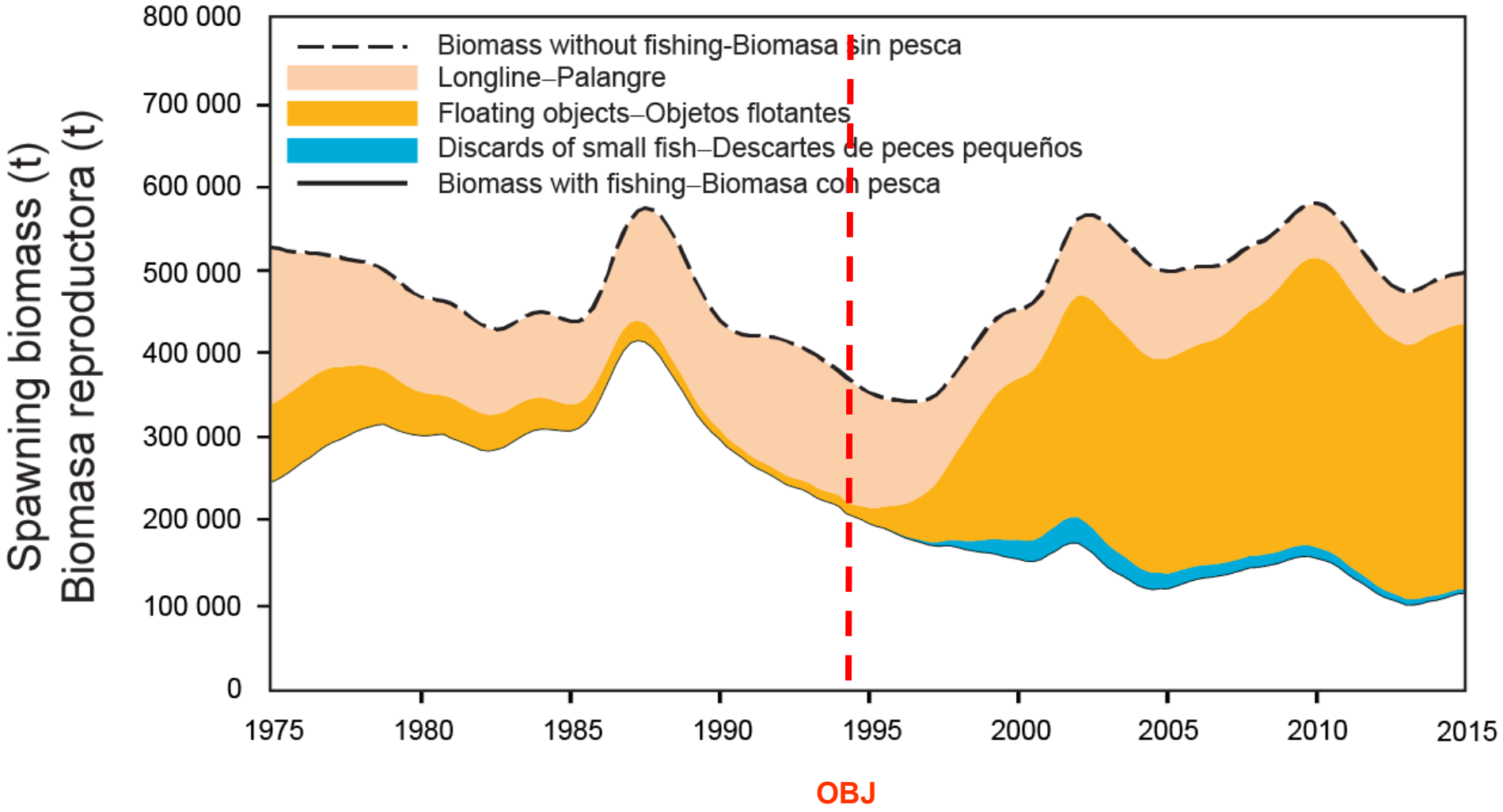




Fishery impact

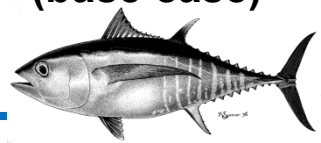
Results
(base case)

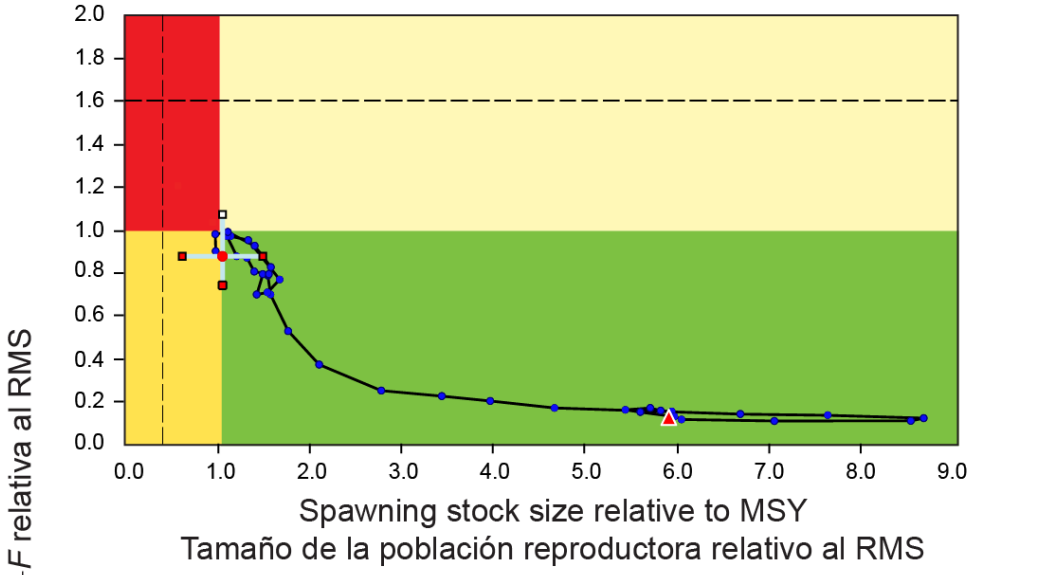


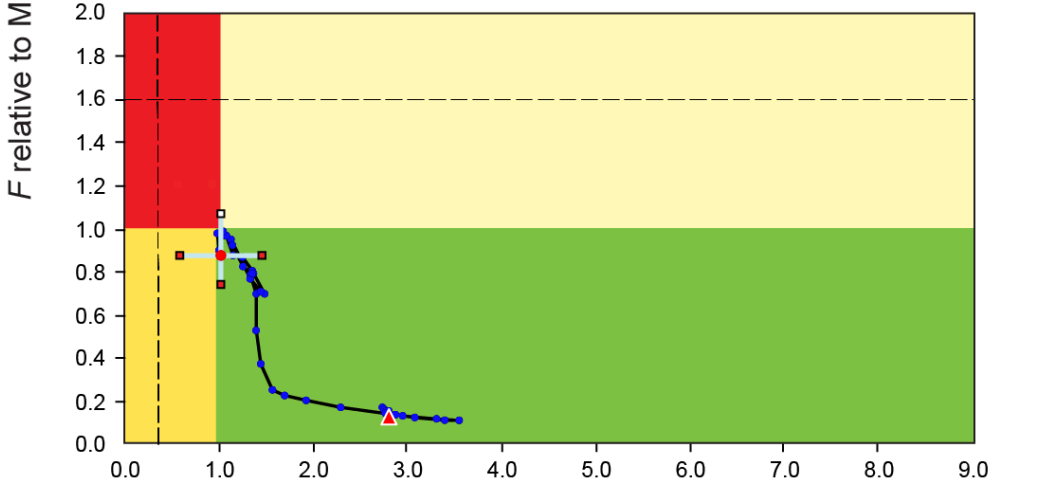


Target and Limit Kobe plot

Stock status (base case)







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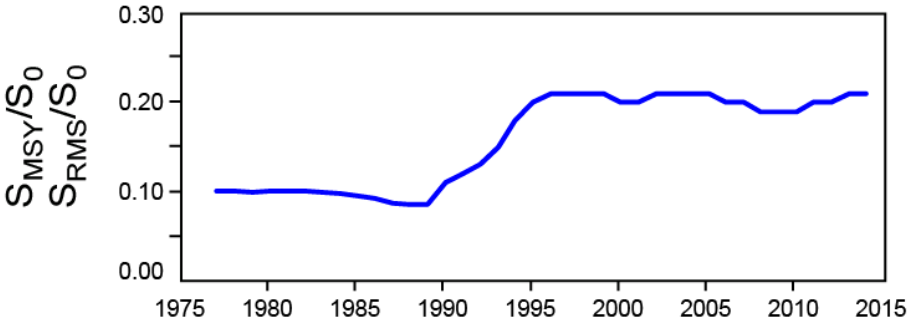
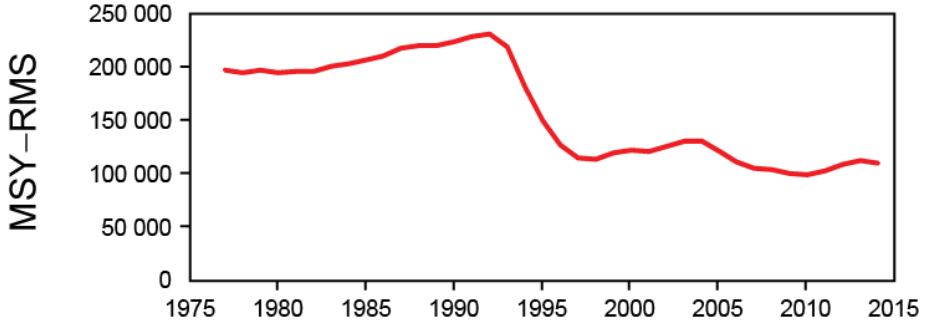
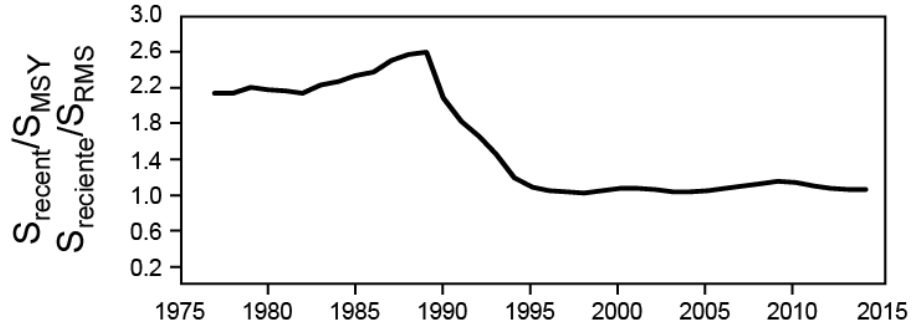
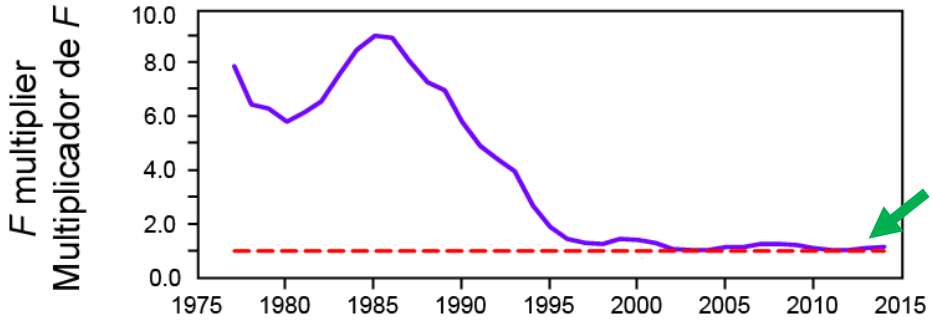
Time varying indicators

Stock status (base case)

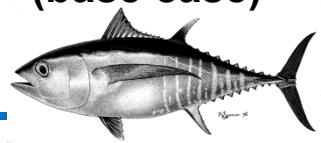








Management quantities



	Base case- Caso base	$h = 0.75$
MSY-RMS	113,730	110,075
B_{MSY}- B_{RMS}	433,396	778,733
S_{MSY}- S_{RMS}	108,502	216,205
B_{MSY}/B_0- B_{RMS}/B_0	0.25	0.33
S_{MSY}/S_0- S_{RMS}/S_0	0.21	0.30
C_{recent}/MSY- C_{recent}/RMS	0.87	0.90
B_{recent}/B_{MSY}- B_{recent}/B_{RMS}	1.03	0.82
S_{recent}/S_{MSY}-S_{recent}/S_{RMS}	1.06	0.82
F multiplier- Multiplicador de F	1.14	0.92

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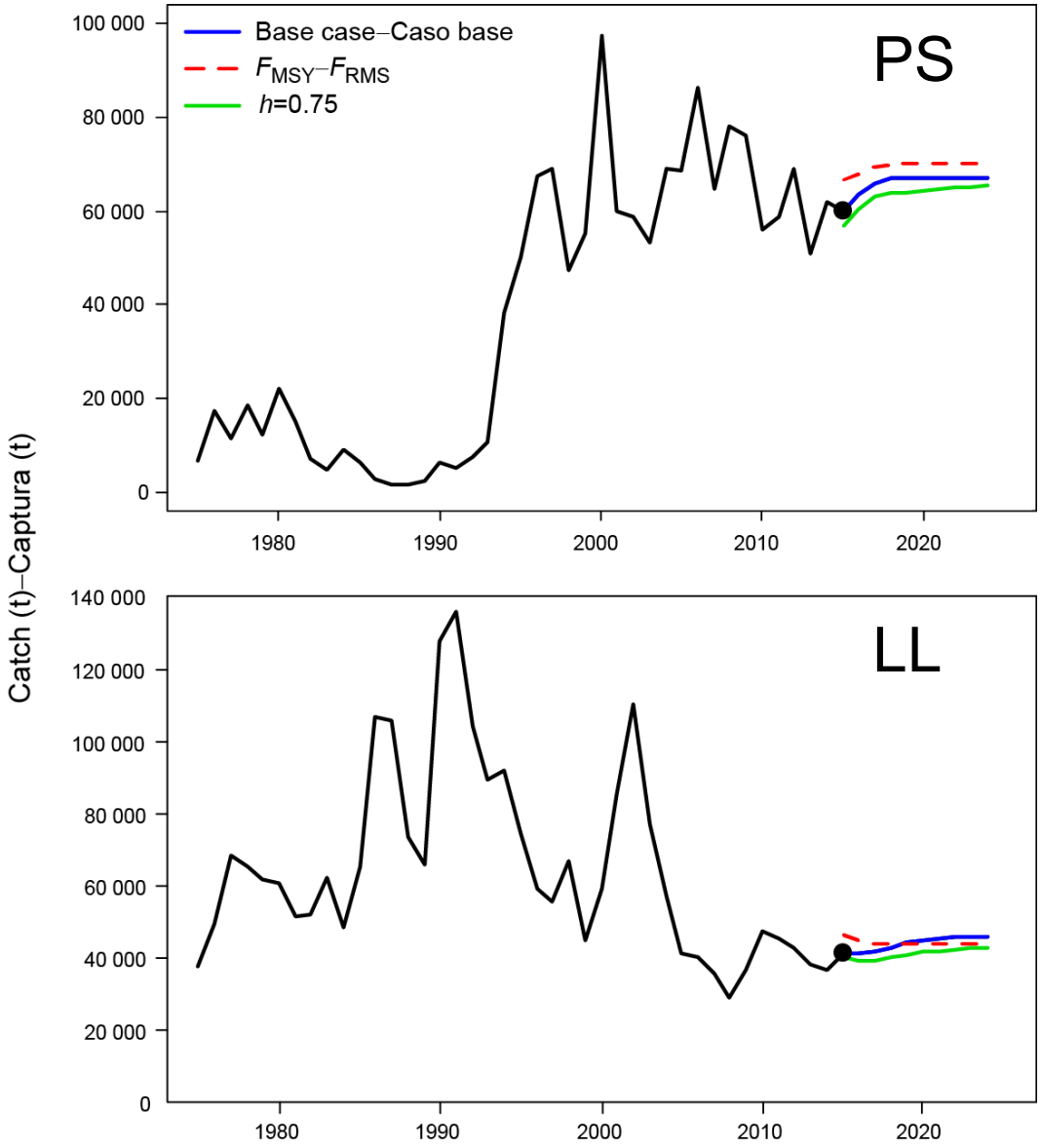
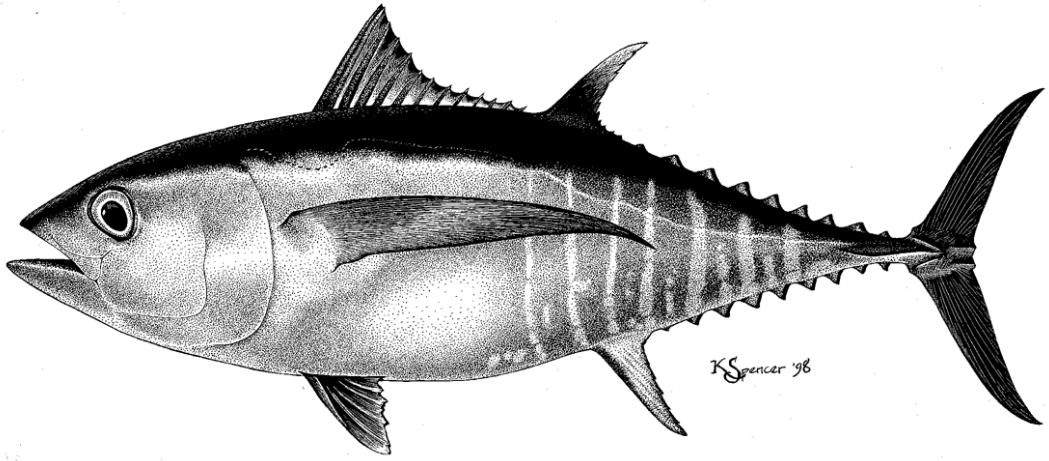
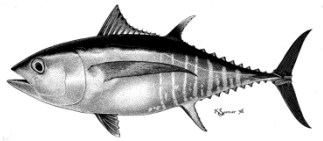
Projected catches – *Status quo* (F_{cur})

Projections (base case)



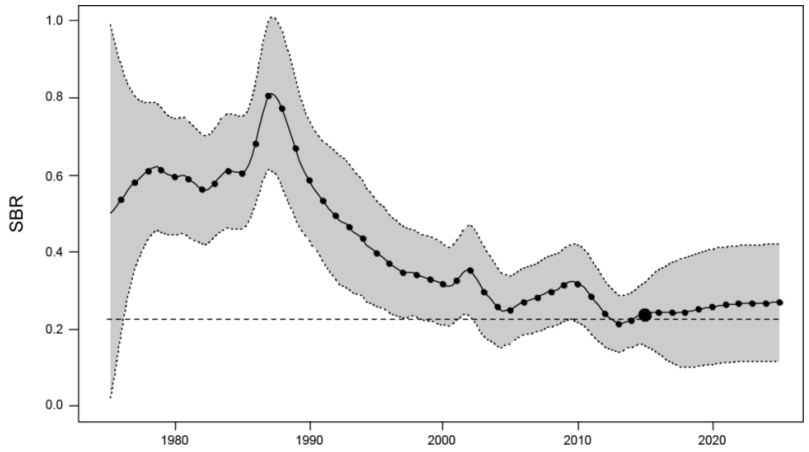


Summary

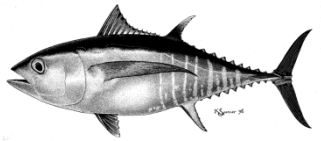


Summary: key results

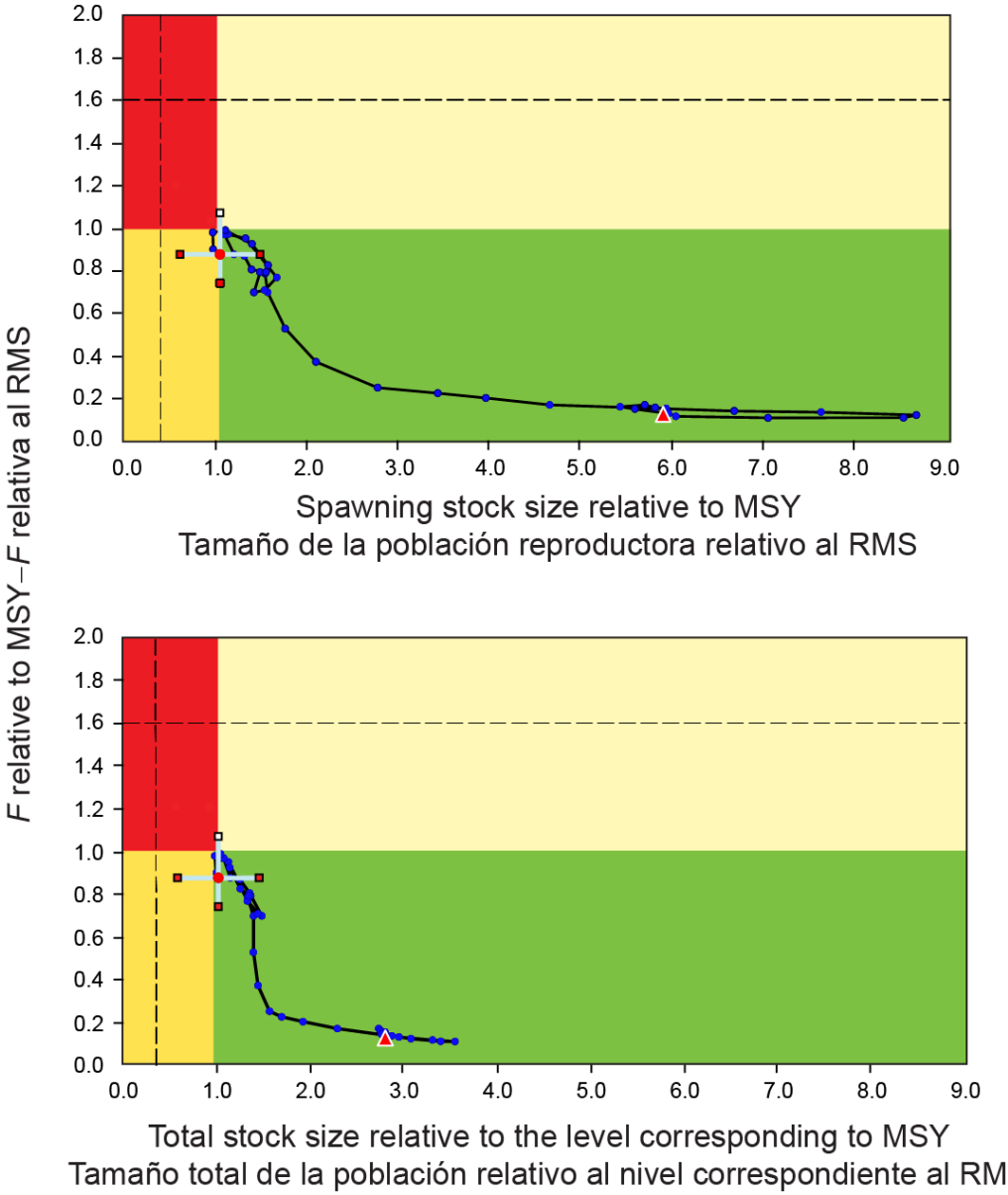
- Population decline observed since the early 1990s ceased around 2005 following IATTC conservation resolutions
- The recent decline since 2010 may be related to series of below average recruitments coinciding with strong La Nina events (since 2007)
- The recent improvement since 2012 is driven by a recent increase in the longline CPUE data
- At current fishing mortality levels, and average recruitment, SBR is predicted to stabilize slightly above SBR at MSY



Summary: key results (cont.)

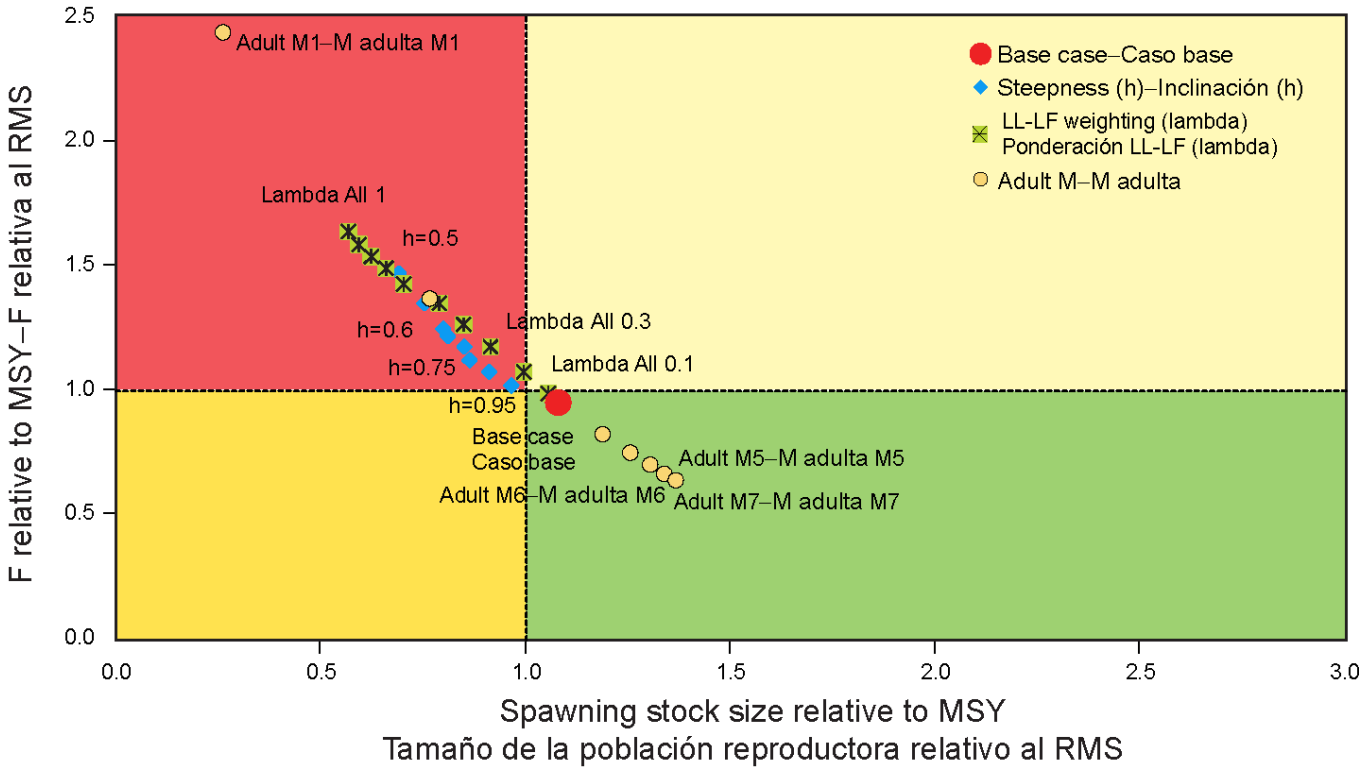


- The recent levels of spawning biomass are estimated to be slightly above the MSY level ($S_{recent} > S_{MSY}$), not overfished
- The recent fishing mortality rates are estimated to be below the level corresponding to MSY ($F_{recent} < F_{MSY}$), overfishing not taking place
- But the recent estimates are uncertain (low precision)
- Proposed limit reference points of 0.38 S_{MSY} and 1.6 F_{MSY} have not been exceeded

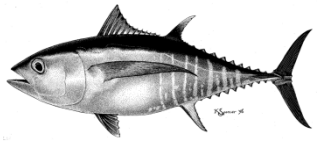


Summary: key results (cont.)

- However, these interpretations are highly sensitive about the following assumptions:
  - Steepness of stock-recruitment relationship
  - Adult natural mortality levels
  - Weighting assigned to the size composition data



Plausible Sensitivities and Uncertainties



- Results are more **pessimistic** with:
  - The inclusion of a stock-recruitment relationship
  - Lower rates of adult natural mortality (*M*)
  - Up-weighting the size composition data (LL in particular)
  - Higher L_2 (but uncertainty has been reduced with recent growth study)

- Results are more **optimistic** with:
  - Higher rates of adult natural mortality (*M*)
  - Lower L_2 (unlikely under the recent growth study)

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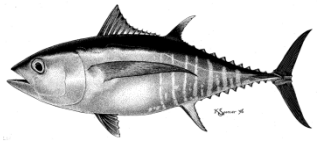
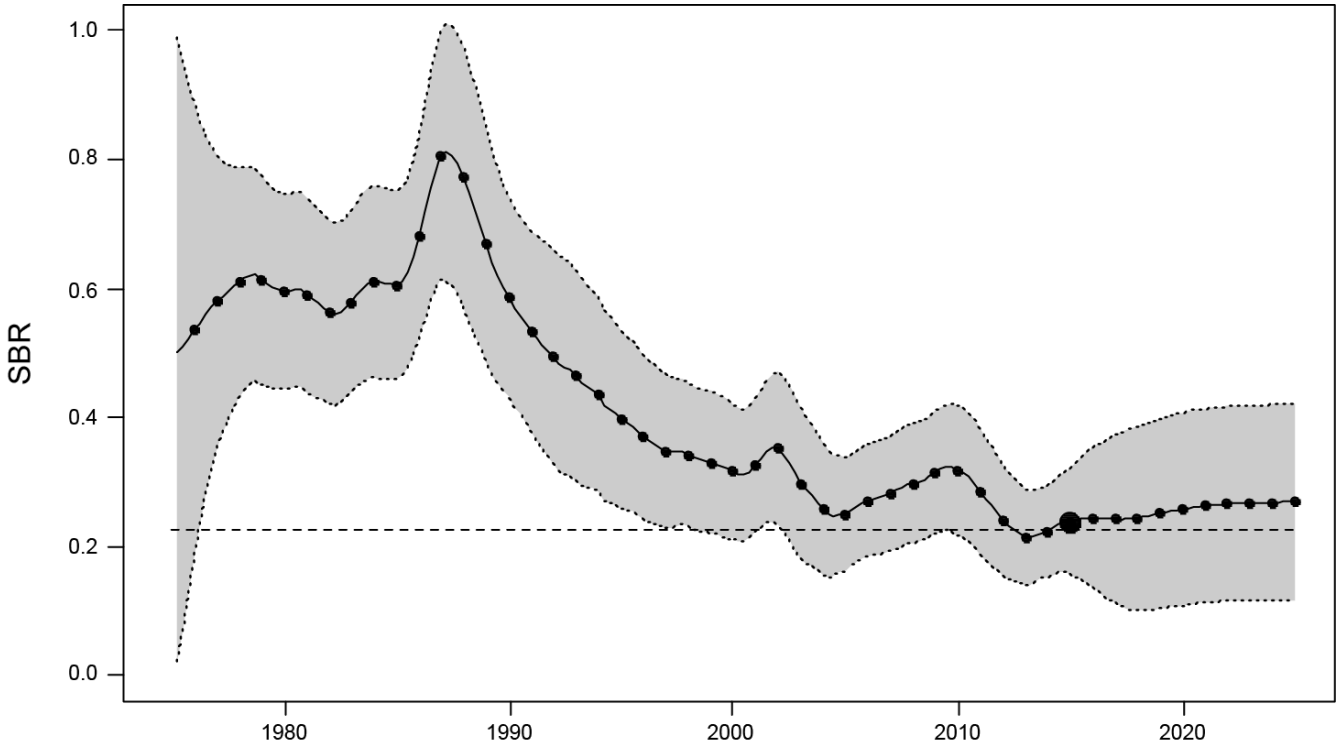
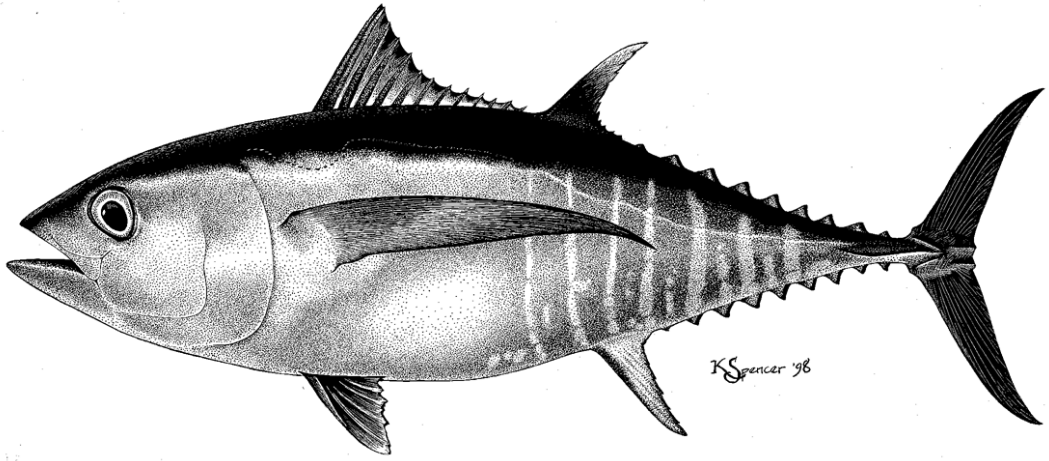


What is robust

- Relative trend
- Lower biomass compared to historic levels





OBJ indicators

Carrying capacity

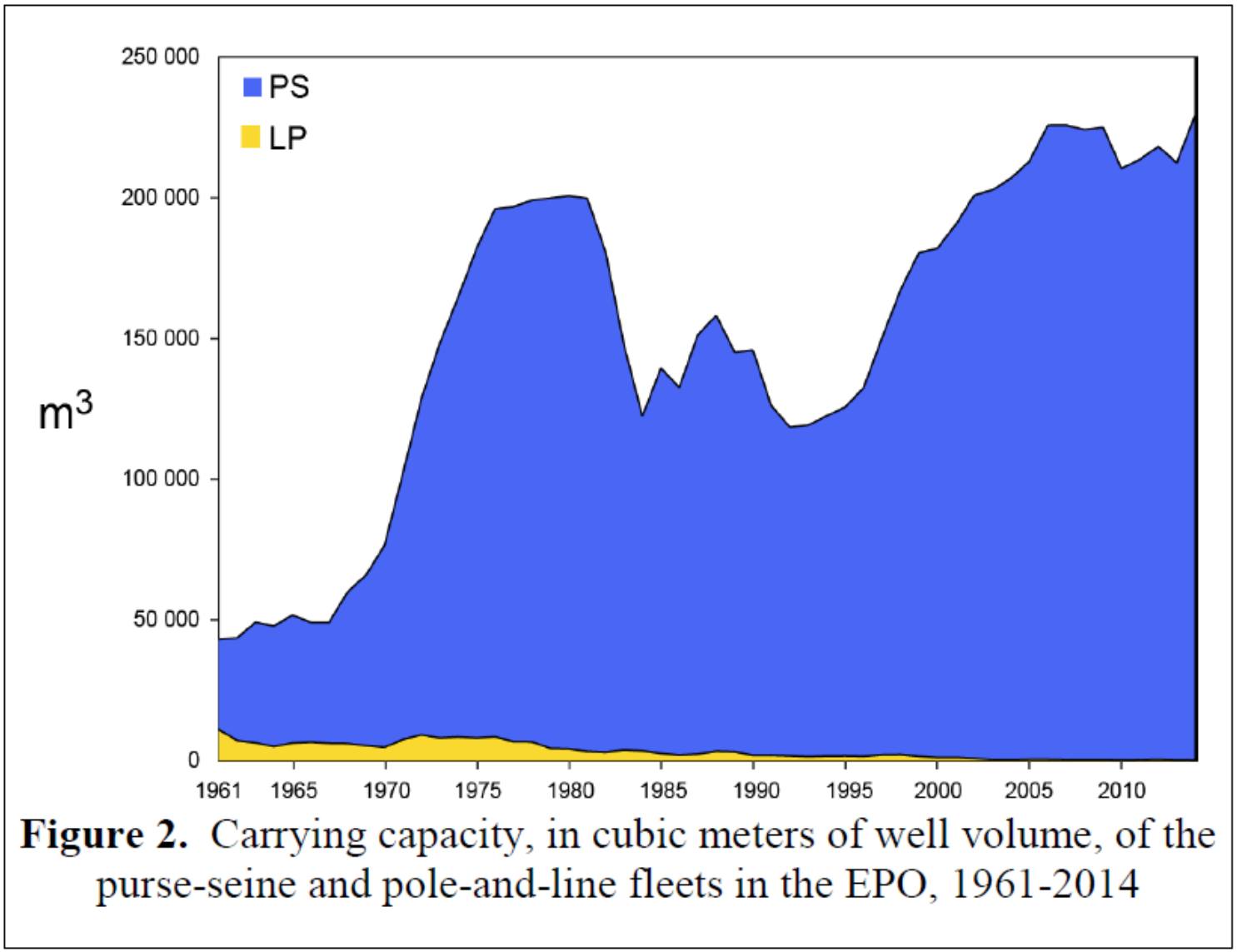
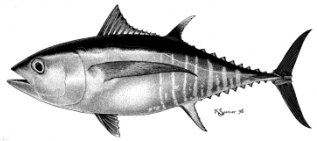
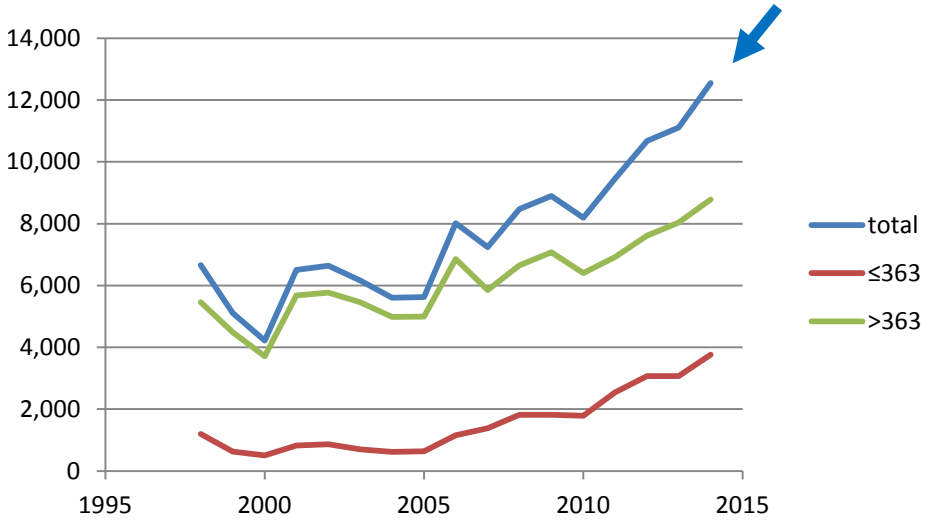


Figure 2. Carrying capacity, in cubic meters of well volume, of the purse-seine and pole-and-line fleets in the EPO, 1961-2014

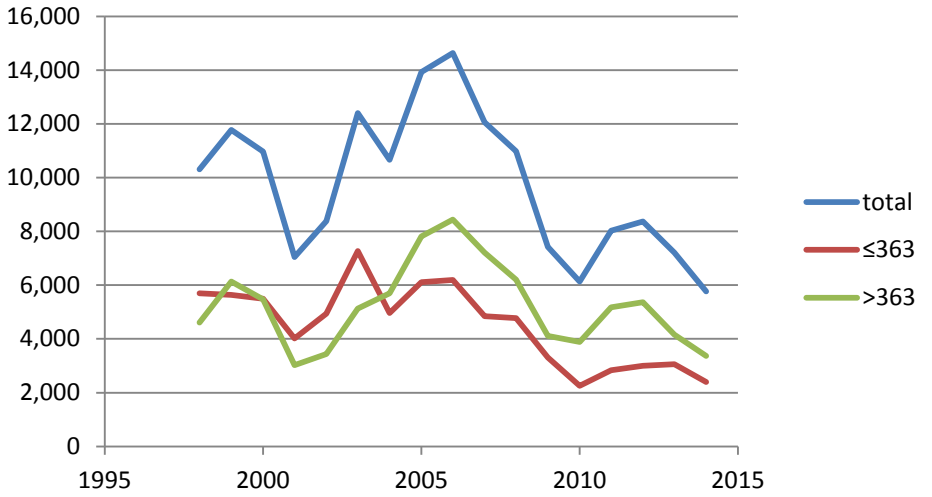
Numbers of sets



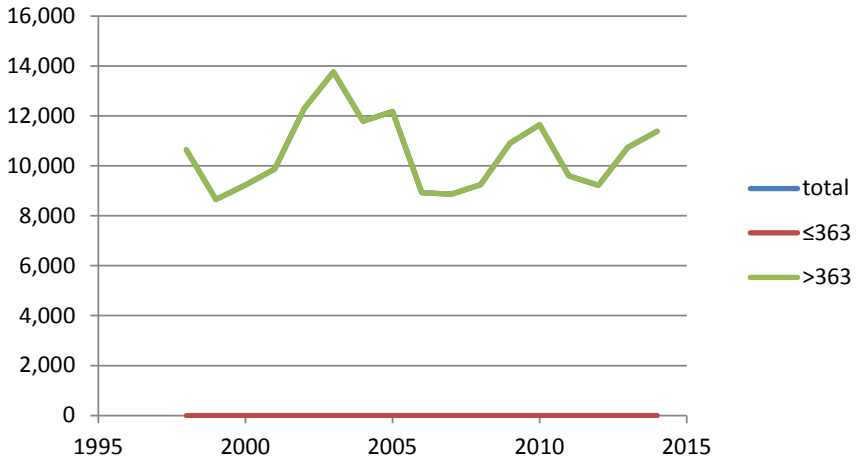
Number of OBJ sets

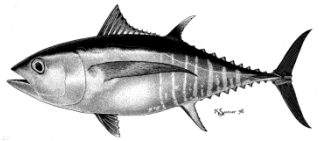


Number of UNA sets



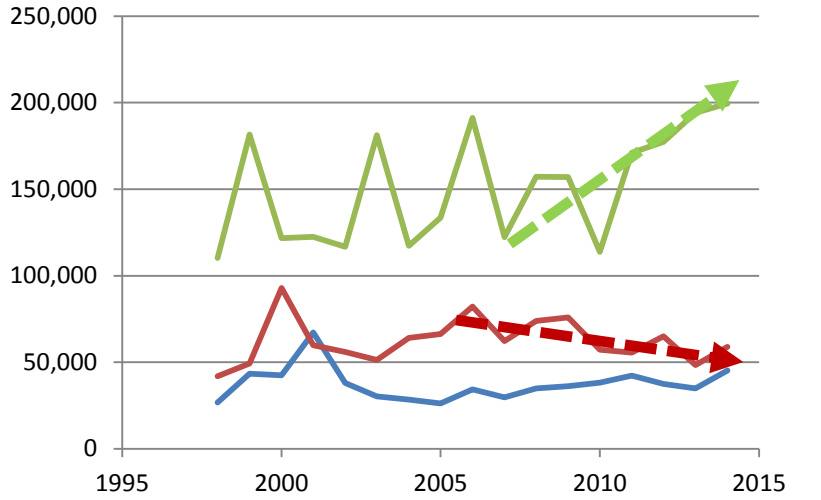
Number of DEL sets



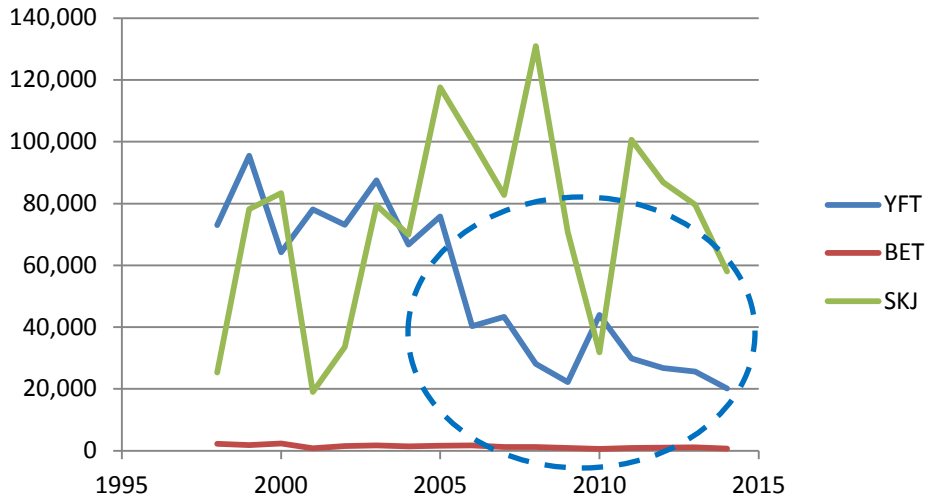


Catches

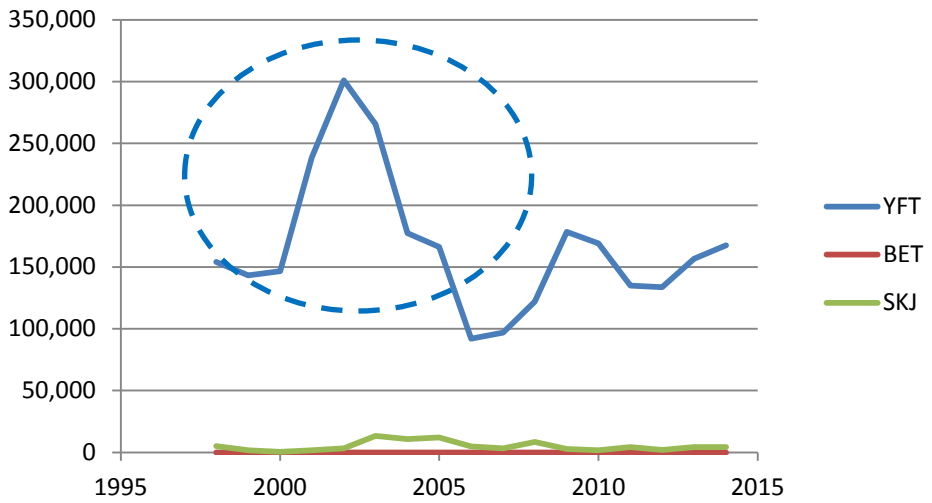
OBJ sets



UNA sets

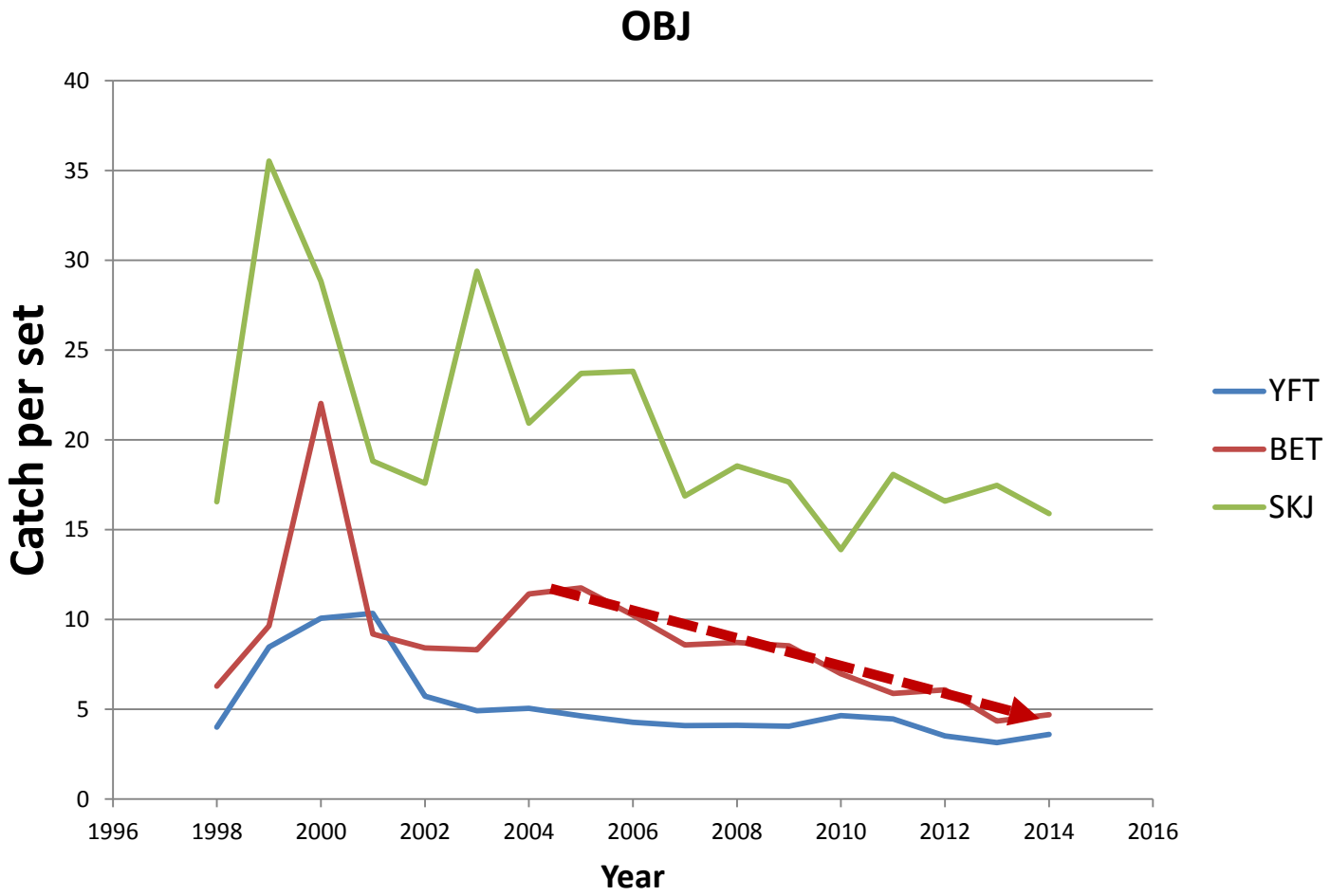


DEL sets

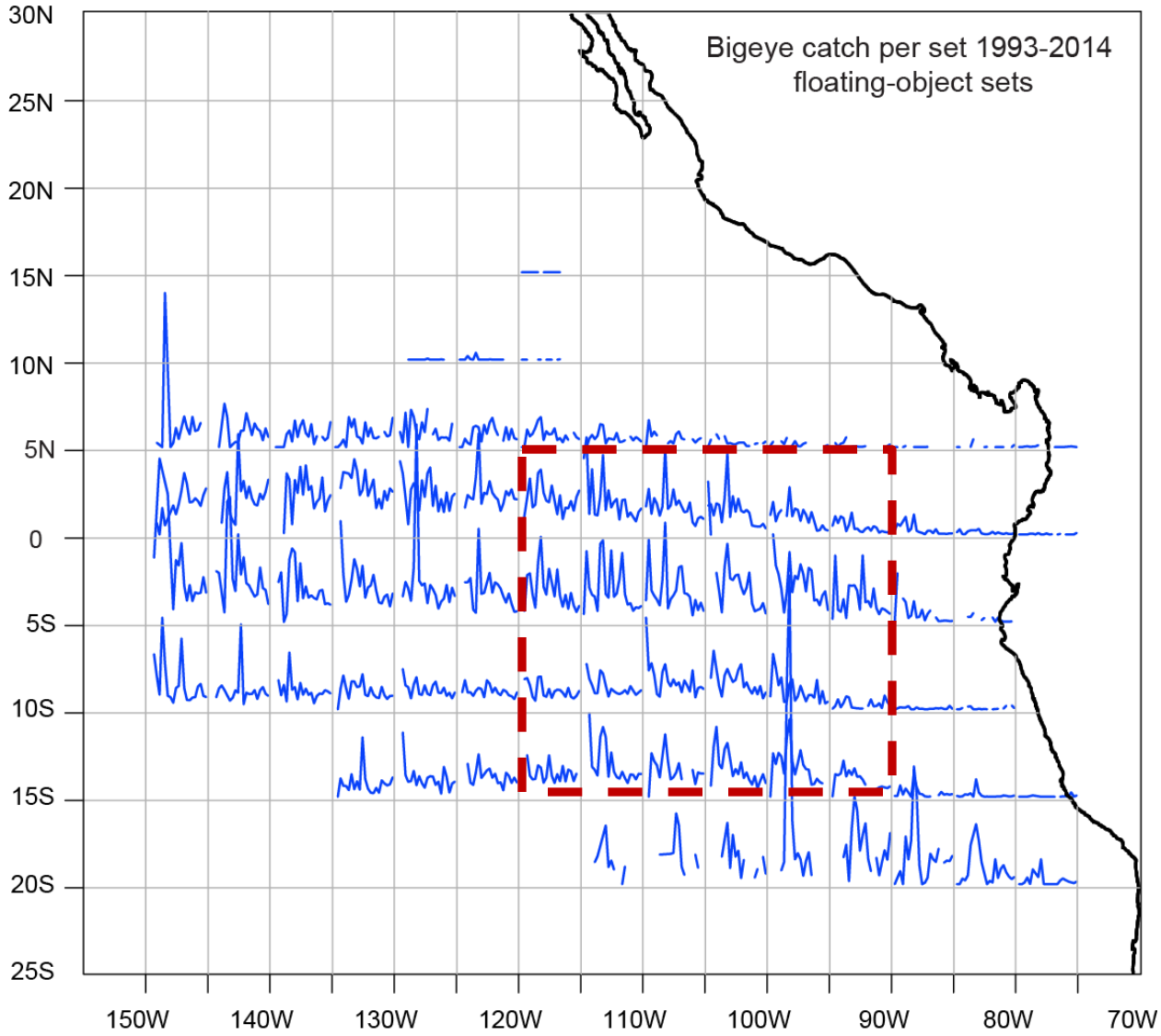


CIAT
IATTC

OBJ catch per set

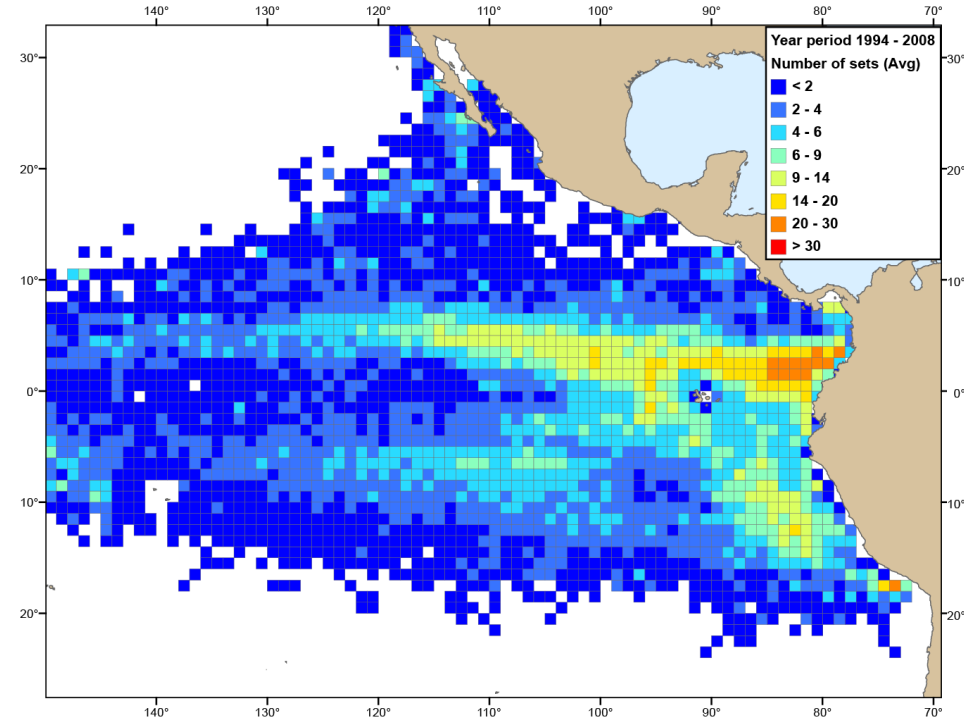


OBJ catch per set – spatial pattern

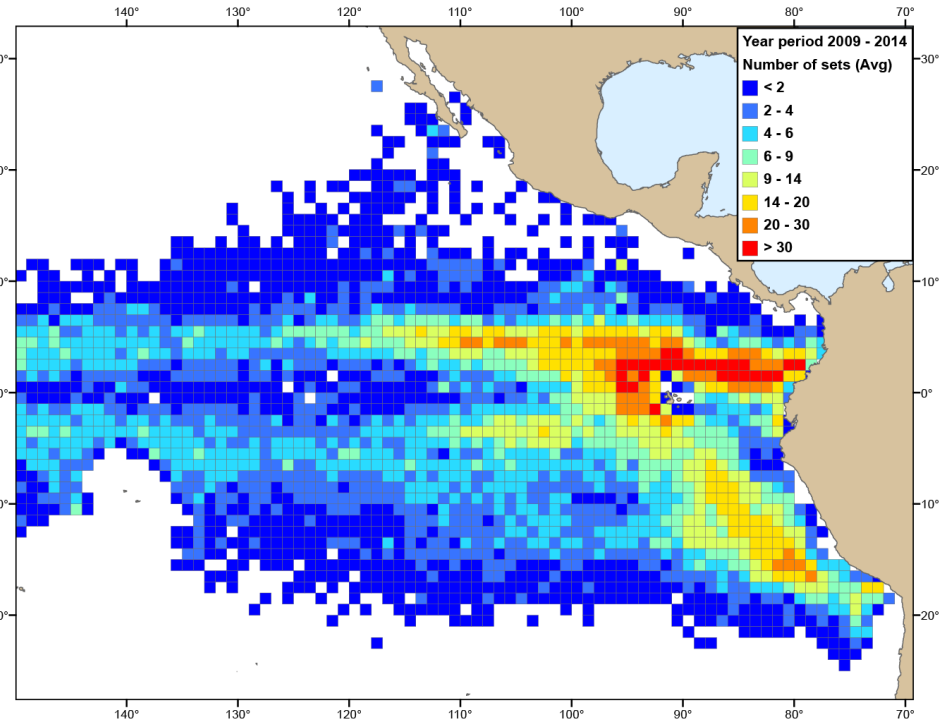


Spatial distribution of OBJ sets

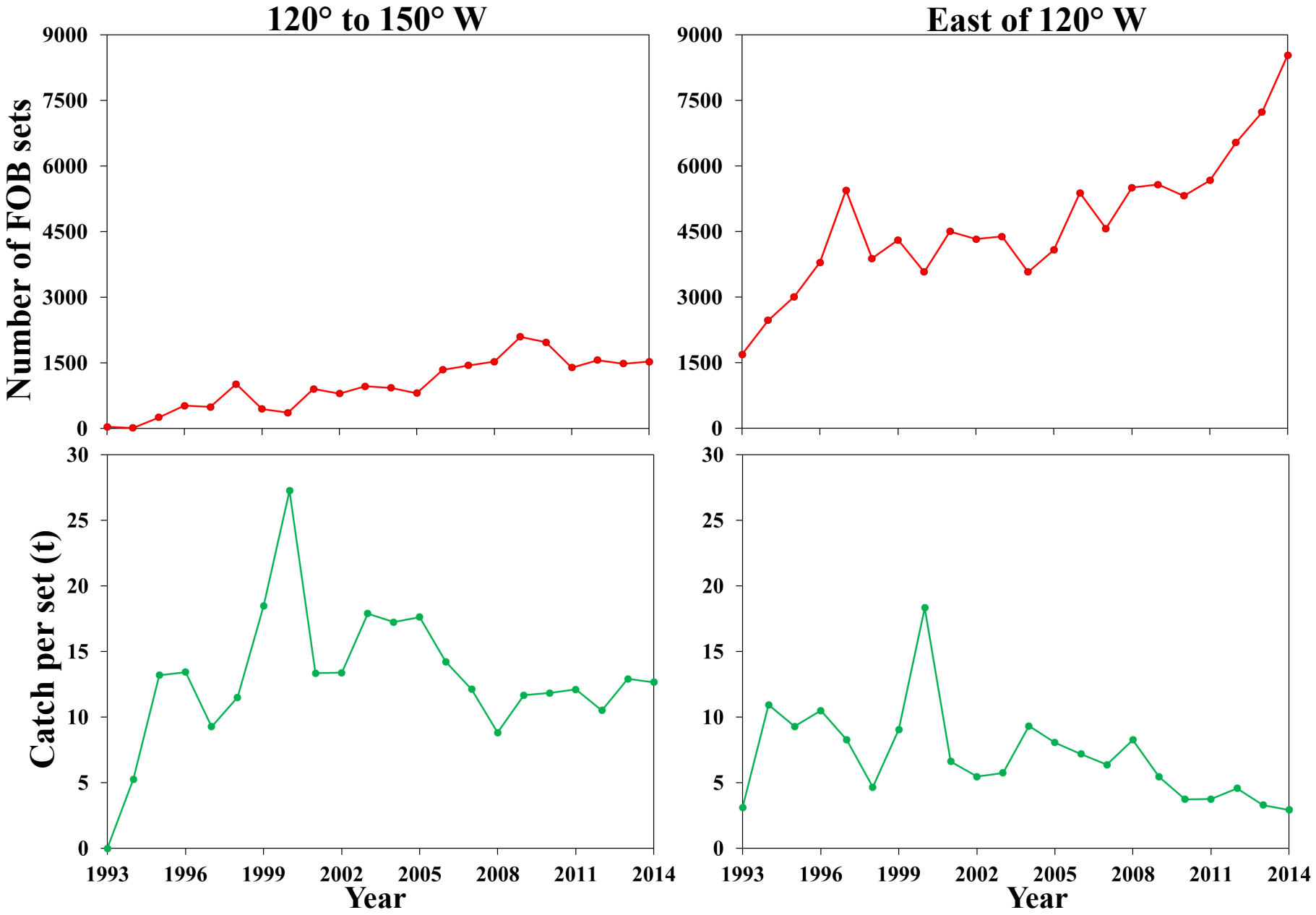
1994-2008

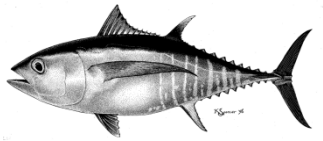


2009-2014



Number purse-seine floating object sets and catch of bigeye tuna between 10° N and 10° S





Hypotheses

- Alternative hypothesis for lower BET catch per set
  - H1: lower abundance
  - H2: decreased density of BET schools per FAD due to increased numbers of FADs
  - H3: Change of targeting practices (e.g. shift to SKJ, avoiding BET "because it makes poor canned product")

Questions?